A 126

(19) Japan Patent Office (JP)
(11) Japanese Patent Application Publication Number - Heisei 02-92603
(12) Kokai Patent Gazette (A)
(43) Kokai Publication Date April 3, 1990

(51) Int. Cl[5] I	Identification symbol	Patent Office Reference Number
B 29 C 43/18		7639-4F
43/56		7639-4F
G 11 B 7/26		8120-5D
11/10	A	7426-5D
//B 29 L 17:00		4F

Examination of Claims, Not requested
Number of claims: 1 (Total number of pages: 4)

(54) **Name of the Invention** Manufacture of Data Recording Board with Guide Groove
(21) **Application filing number** Showa 63-246380 (1987)
(22) **Date of filing** Showa 63 (1988) September 30
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Details of the Invention

1. Name of the Invention

Manufacture of Data Recording Board with Guide Grooves

2. Scope of Patent Claims

(1) What is claimed is a manufacturing method for a data recording board with guide grooves in which a hardening resin is spread over a substrate board and/or stamper mold on which there is a convexoconcave pattern; between the aforementioned substrate board and the aforementioned stamper mold is placed a layer of the aforementioned hardening resin; next there is a decrease in pressure between the aforementioned substrate board and the aforementioned stamper mold; then pressure is increased, on at least one side of either the aforementioned substrate board and the aforementioned stamper mold; after appropriate procedures the aforementioned hardening resin is hardened; the convexoconcave pattern of the stamper mold is transcribed into the hardening resin; and the aforementioned substrate board, which is affixed, to the aforementioned stamper mold is then removed from the stamper mold.

3. Detailed Description of the Invention

Industrial Field of the Invention

This invention is a method for manufacturing a data recording substrate board with guide grooves.

Current Techniques

There are already other types of data recording substrates with guide groves, for example the Japanese examined patent publication Showa 53-33244 (1978). Following is the method of manufacture.

First, a dispenser drips a high viscosity, ultraviolet-light-hardening resin onto the surface of a stamper mold, which has the convexoconcave pattern that creates the guide grooves. The dispenser drips the resin onto the center of the stamper mold. If, for example, the drops are applied in the center of the radius of a circular stamper, and the stamper mold is allowed to rotate, the resin moves across the surface as concentric rings.

Next, after the resin as been dripped onto the surface of the stamper mold. Then, for example, a transparent disk plate made of glass is put in place and pressure is applied with an oil pressure or other device and the resin is pressed between the stamper mold and the transparent disk plate, and the resin completely fills the convexoconcave pattern on the stamper mold.

Next, ultraviolet light shines onto the transparent disk board hardening the ultraviolet light hardening resin that forms the guide grooves. After the guide grooves are glued to the top of the transparent disk plate, the transparent disk plate and the stamper are peeled apart producing the desired optical data recording disk plate with guide grooves attached.

Problem that is Solved by the Invention

However, the existing manufacturing methods for making data recording substrate plates employ high viscosity (100 to 800 centipoises) UV-hardening resin (for example, dibentaerythritol pentaacrylate, dibentaerythritol hexaacrylate, and other polyfunctional acrylates). Consequently, after the stamper mold presses and spreads the resin, the bubbles that were in the resin remain. Because of this, there are bubbles in the convexoconcave pattern that was created during transcription of the stamper mold. The bubbles cause the protuberances to splinter, and in the worst cases protuberances do not even form. Thus, it is not possible to obtain a faithful copy of the convexoconcave pattern of the stamper mold. If data recording substrates have defects in the guide grooves, when the magneto-optical disks are made, there will be problems in the recording capacity of the magneto-optical disks.

With this invention it is possible to eliminate these problems and defects by removing the bubbles in the hardening resin. This makes it possible to reliably copy the convexoconcave pattern of the stamper mold to make guide groves and thus provides a manufacturing method for making data-recording substrates with guide grooves.

Procedures for Solving the Problem

This invention achieves the aforementioned purpose. It is a manufacturing method for producing substrate plates that can be used for data recording that has guidance grooves attached. A hardening resin is applied to a substrate disk and/or to a stamper mold that has a convexoconcave pattern. After the hardening resin has been applied to the aforementioned convexoconcave pattern, the space between the aforementioned substrate

and the aforementioned stamper has the aforementioned hardening resin spread out. Next, the pressure is lowered between the aforementioned substrate and the aforementioned stamper. Then pressure is increased, on at least one side of either the aforementioned substrate or the aforementioned stamper. After a suitable interval, the aforementioned hardening resin is hardened. The convexoconcave pattern of the aforementioned stamper mold is transcribed into the resin and is hardened by the hardener of the resin. The hardened resin of the aforementioned substrate is then pealed off the aforementioned stamper.

Operations

With this invention, when the pressure is lowered between the substrate plate and the stamper mold, it can help prevent air bubbles from remaining in the hardening resin.

Embodiments

Following are explanations of embodiments of the invention and refers to figures.

Embodiment 1

Disk substrate plate 1 is a soda-lime glass plate with an outer diameter of 130 mm, and an opening in the center with a diameter of 15 mm. A dispenser applies UV hardening resin 2 (manufactured by Ooyamatone Ink, Corp., Daikyuu-akuria STM 401, viscosity 320 centipoises) to the top of disk substrate plate 1. It is applied to about the center of where it will be spread radially (refer to Figure 1 (a)).

Next, disk substrate plate 1 with UV-hardening resin 2 is turned downwards. UV-hardening resin 2 comes in contact with the convexoconcave pattern on the surface of stamper mold 3 and the disk substrate plate 1 and stamper mold 3 become joined. (Refer to Figure 1 (b)).

The protruding parts of the convexoconcave pattern stamper mold have widths of 0.6 to 0.8 μm, and the indentations measure widths of 0.8 to 1.0 μm. The depths of the indentations are about 750 Å.

Next, the laminated disk substrate plate 1 and stamper mold 3 are put into the processing vessel. Then the pressure in the area between disk substrate plate 1 and stamper mold 3 is lowered to 1 torr. This removes the bubbles that remained in UV-hardening resin 2. Then the pressure on both the side of disk plate 1 and the side of stamper 3 is increased to 0.5kg/cm^2. With the bubbles gone, UV-light hardening resin layer 2a is uniform. (Refer to Figure 1 (c)). The process of raising and lowering the pressure within processing vessel 4 takes place in interior containment box 5. The interior containment box contains O-rings 6. Lowering of the pressure is done via the spacer for reducing pressure A and conversely the pressure is raised using the spacer for increasing pressure B. To lower the pressure between disk plate 1 and stamper 3, a vacuum pump is operated to remove air through the aforementioned spacer for reducing pressure A. Then the pressure is increased from both the side of disk substrate 1 and the side of the stamper mold 3 using a high-pressure gas such as N_2 that passes through the aforementioned spacer for increasing pressure B.

Then, while disk substrate plate 1 and stamper mold 3 are affixed by pressure, the processing vessel 4 is exposed to UV light (UV-ray lamp, power 300 W) for 30 seconds. The UV-light 8 is on the outside of processing vessel 4 and passes through upper plate 7

that is made of glass. The light passes through transparent disk substrate plate 1 to harden UV-hardening resin 2a forming guide groves 9 (refer to Figure 1 (c)).

Next, laminated disk substrate plate 1 and stamper 3 are removed from the processing vessel, and the former is peeled from the latter. This produces the intended disk substrate plate with guide grooves 9 (refer to Figure 1 (d)). Now, excess UV-hardening resin 2 that is attached to the side of disk substrate plate 1 is removed by, for example, a thin knife.

In this embodiment 1, the reduction in pressure in the area between disk substrate plate 1 and stamper mold 3 causes the bubbles that remain in the hardening resin in this space to disappear. Guide groves 9 that are attached to disk substrate 1 have been reliably copied from the convexoconcave pattern of the stamper mold. Unlike the previously described existing method, the guide grooves do not have defects. Therefore, these disks with guide grooves attached can be used as optical disks with superior qualities for recording, etc.

Embodiment 2

The same type of disk substrate plate is used as in embodiment. 1. The UV-hardening resin is polyurethane acrylate that has been diluted with isopropyl alcohol (manufactured by Ooyamatone Ink, Corporation, Daikyuu STM-401. Viscosity after dilution is 30 to 50 centipoises.) The resin is dispensed with a set measuring pump, etc. The resin is dripped onto the central part of the disk on the side with the opening forming circular concentric patterns.

Next, a spinner (manufactured by N-TEC Company) is used to spin-coat the resin (at 2000 revolutions per minute) so that the dripped resin spreads out over the entire surface of the disk substrate.

The following is the same as for embodiment 1. The resin-coated surface of the disk substrate plate and the convexoconcave surface of the stamper mold face each other, and the disk substrate and the stamper mold are joined. Then, using the same processing vessel as in embodiment 1, the pressure between the substrate and the stamper mold is lowered. Then high pressure is applied to both sides of the disk substrate plate and stamper mold and the UV-hardening resin is hardened with ultraviolet light. Then the laminated disk substrate plate and stamper mold are removed from the said processing vessel and the former is peeled from the latter. This produces the intended disk substrate plate with guide groves.

As embodiment 2 uses a hardening resin with a lower viscosity than the hardening resin used in the aforementioned embodiment 1, it is possible to use a spin-coating method to spread an even layer of the UV-hardening resin. Thus, the resin can fill in and smooth out the convexoconcave pattern of the stamper mold. Therefore, in embodiment 2 there are fewer bubbles remaining in the resin than in the aforementioned embodiment 1. Moreover, with this method the few remaining bubbles between the disk substrate plate and the stamper mold are removed during the low-pressure treatment. It is possible to obtain the desired convexoconcave pattern from the stamper mold with extreme faithfulness. In this embodiment 2, isopropyl alcohol is used as a solvent to dilute the UV-hardening resin. During the aforementioned low-pressure treatment, this solvent is removed. Thus there is no problem with the solvent remaining in the resin and interfering with the hardening catalyst in the resin.

In the above, the embodiments explain this invention. However, following are other ways that this invention can be achieved.

(1) In the above, a UV-hardening resin is used in the embodiments, but resins that can be hardened with electricity, heat, etc. can also be used.

(2) In these embodiments the resin is spread out over the surface of the disk substrate plate, but it is also acceptable to spread it on the stamper mold. It is also acceptable to spread the resin on both the disk substrate plate and the stamper mold. The application methods in these embodiments employed a dispenser and used spin coating. However, depending on the nature of the resin, it is also possible to use roll-coat or other method.

(3) In these embodiments, the disk substrate plates are made of soda lime glass. However, other materials can also be used including other types of glass, epoxy resin, or polycarbonate, and other types of plastic, etc. When UV-hardening resin is used, it is necessary that the substrate plate allow the transmission of ultraviolet light from above so it is necessary that it be transparent. If a transparent stamper mold is used, it is possible for UV-ray rays to enter from the stamper side, and disk substrate plates could be non-transparent.

(4) In the embodiments, the stamper mold that is used is made of nickel, but other materials can also be used. According to what has been written above, if a transparent stamper mold is used, it is possible to shine the UV-rays from the stamper mold side.

(5) In the embodiments, after the substrate plate and stamper mold are laminated, high pressure is added from both sides - to both the substrate plate and the stamper mold. However, it is also acceptable for the pressure to be added from only one side, either the substrate plate side or the stamper mold side. High-pressure gas was used as the method for increasing pressure, but other methods such as one that depends on an oil pressure device can also be used.

Result of the Invention

According to the aforementioned, by using the methods of this invention the bubbles in the hardening resin in the space between the substrate plate and the stamper mold are removed by lowering the pressure. It is possible to obtain data recording substrate plates in which the convexoconcave pattern of the stamper mold has been faithfully reproduced to obtain guide groves.

4. Brief Explanation of the Figures

Figure 1 shows process drawings of an embodiment of this invention.

1-Disk board
2-Resin that can be hardened with ultraviolet light
2a-Layer of resin that can be hardened with ultraviolet light
3. Stamper mold
4-Processing vessel

5- Interior containment box
6-O-ring
7-Upper plate made of glass
8-Ultraviolet light
9-Guide grooves
A-Spacer area for reducing pressure
B-Spacer area for increasing pressure

Figure 1.
(a)
(b)
(c)
[Start labels in figure. Left side of figure, top to bottom]
High-pressure gas
High-pressure gas
[right side of figure]
Vacuum pump
[End labels in figure]
(d)

1-Disk substrate plate
2-Resin that can be hardened with ultraviolet light
2a-Layer of resin that can be hardened with ultraviolet light
3. Stamper mold
4-Processing vessel
5- Interior containment box
6-O ring
7-Upper plate made of glass
8-Ultraviolet light
9-Guide groove
A-Spacer for reducing pressure
B-Spacer for increasing pressure

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